

Evaluate Changes in the Physical and Chemical Properties of Soils as a Result of Ozonation

Goal: To research the changes to the physical properties of soils following injection of gaseous ozone using laboratory soil columns. Physical properties that will be studied are saturated hydraulic conductivity, clay dispersion, swelling, and soil hardness. This sub-task will also analyze the chemical composition of the leachate from soils following injection of gaseous ozone, including salts and nutrient concentrations, pH, and soluble organic matter.

Technology Path: Experimental results from this study (using soils collected from SoilZone's field demonstration sites, as described in sub-task 1C), will quantify changes to the soil chemical and physical properties as a result of ozonation. The quantitative data gathered under this sub-task can be used by farmers to design their ozone fumigation process for optimum performance at their field plots with the knowledge of their soil characteristics. At the completion of this task the researchers expect the technical knowledge to be available for use by SoilZone and others as a reference guide on soil characteristics and its effects on ozone. The research laboratory results will be used to develop a new research phase involving actual field evaluations requiring one additional year of monitoring at a cost of approximately \$100,000.

Energy Efficiency Benefits: This sub-task complements Task 1C in developing scientific data that would be useful in the design of optimized ozonation systems. The energy efficiency benefits to be gained from this research are primarily indirect by understanding the physical and chemical soil properties that farmers will need to operate ozone fumigation systems with optimum performance while minimizing the dosage and frequency of ozone application.

Technical Objectives:

- Characterize the changes to the physical properties of soils following injection of gaseous ozone using laboratory soil columns. The physical properties that will be studied are saturated hydraulic conductivity, clay dispersion, swelling, and soil hardness. These studies will be done using soil samples from field projects where ozonation is currently being tested.
- Analyze the chemical composition of the leachate from soils following injection of gaseous ozone. The chemical properties that will be studied include the salt and nutrient concentrations, pH, and soluble organic matter.
- Simulate the effects of long-term ozonation of soils by repeated wetting, ozonation, leaching, and drying.
- Determine the effects of ozone plus carbon dioxide mixtures on soil physical and chemical properties.

- Determine the effects of soil water content at the time of ozonation on leachate composition.
- Extract the organic matter from soils for ^{13}C NMR and spectroscopic analysis to characterize changes in the organic matter composition as a result of ozonation.

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